CLAIMS

1. An audio watermarking system comprising

a pattern generator to generate both a strong watermark and a weak watermark; and

a watermark insertion unit to insert the strong watermark and the weak watermark into the audio signal.

2. An audio watermarking system as recited in claim 1, wherein the watermark insertion unit selectively inserts the strong watermark or the weak watermark into segments of the signal according to an audible measure of the segments.

3. An audio watermarking system as recited in claim 1, further comprising:

a processor to determine a hearing threshold for the audio signal; and

the watermark insertion unit inserts the strong watermark when the signal exceeds the hearing threshold and insert the weak watermark when the signal falls below the hearing threshold.

4. An operating system comprising an audio watermarking system as recited in claim 1.

5. An audio watermark encoding system comprising:

a converter to convert an audio signal into magnitude and phase components;

a mask processor to determine a hearing threshold for corresponding magnitude components;

a pattern generator to generate both a strong watermark and a weak watermark; and

a watermark insertion unit to selectively insert one of the strong watermark or the weak watermark into the audio signal based on whether the magnitude components exceed or fall below the hearing threshold.

6. An audio watermark encoding system as recited in claim 5, wherein the watermark insertion unit inserts the strong watermark when the magnitude component exceeds the hearing threshold and inserts the weak watermark when the magnitude component falls below the hearing threshold.

7. An audio watermark encoding system as recited in claim 5, wherein the watermark insertion unit inserts the strong watermark when the magnitude component exceeds the hearing threshold by a predetermined amount and inserts the weak watermark when the magnitude component falls below the hearing threshold by the predetermined amount.

8. An audio watermark encoding system as recited in claim 7, wherein the watermark insertion unit foregoes inserting the strong watermark or the weak watermark when the magnitude component lies within the predetermined amount above and below the hearing threshold.

9. An audio encoding system comprising:

an audio watermark encoding system as recited in claim 5; and

a compression unit, wherein the compression unit and the audio watermark encoding system both utilize the magnitude components.

10. An operating system comprising an audio watermark encoding system as recited in claim 5.

11. A watermark insertion unit, comprising:

an input to receive frequency magnitude components of an audio signal, hearing thresholds derived from the magnitude components, strong watermark values, and weak watermark values; and

multiple insertion operators for selectively combining the magnitude components and one of the strong watermark values or the weak watermark values depending upon whether the magnitude components exceed or fall below the hearing thresholds.

12. An audio watermark detection system, comprising:

a synchronization module to determine which portion of a watermarked audio signal might contain a watermark; and

a correlation module to detect whether a strong watermark and a weak watermark is present in the portion of the watermarked audio signal.

13. An audio watermark detection system as recited in claim 12, wherein the correlation module computes a correlation value from the watermarked audio signal and the strong watermark that tends toward a first value when the strong watermark is present and a second value when the strong watermark is not present.

14. An audio watermark detection system as recited in claim 12, wherein the correlation module computes a correlation value from the watermarked audio signal and the weak watermark that tends toward a first value when the weak watermark is present and a second value when the weak watermark is not present.

15. An audio watermark detection system as recited in claim 12, wherein the correlation module computes a correlation value from the watermarked audio signal and one of the strong watermark or the weak watermark, the correlation module determining that said one strong watermark or weak watermark is present when the correlation value exceeds a predetermined threshold plus a random amount.

16. An operating system comprising an audio watermark detection system as recited in claim 12.

17. An audio watermark detection system comprising:

a converter to convert a watermarked audio signal into magnitude and phase components;

a mask processor to determine a hearing threshold for corresponding magnitude components;

a pattern generator to generate both a strong watermark and a weak watermark; and

a watermark detector to detect presence of the strong watermark and the weak watermark in the audio signal.

18. An audio watermark detection system as recited in claim 17, wherein the watermark detector computes correlation values from the watermarked audio signal and each of the strong watermark and the weak watermark and detects the presence of the strong watermark and the weak watermark based on whether the correlation values exceed a predetermined threshold.

19. An audio watermark detection system as recited in claim 17, further comprising:

a random operator for generating a random value; and

the watermark detector computes correlation values from the watermarked audio signal and each of the strong watermark and the weak watermark and detects the presence of the strong watermark and the weak watermark based on whether the correlation values exceed a predetermined threshold plus the random value.

20. An audio decoding system comprising:

an audio watermark detection system as recited in claim 17; and

a decompression unit, wherein the decompression unit and the audio watermark detection system both utilize the magnitude components.

21. An operating system comprising an audio watermark detection system as recited in claim 17.

22. An audio watermarking architecture, comprising:

a watermark encoding system to insert a strong watermark and a weak watermark into an audio signal; and

a watermark detecting system to detect a presence of the strong watermark and the weak watermark in the audio signal.

23. An audio watermarking architecture as recited in claim 22, wherein the watermark encoding system resides at a content producer to watermark original audio content and the watermark detecting system resides at one or more clients to detect the watermarks and play the original audio content.

24. An audio watermarking architecture as recited in claim 22, wherein the watermark encoding system comprises:

a converter to convert the audio signal into magnitude and phase components;

a mask processor to determine a hearing threshold for corresponding magnitude components;

a pattern generator to generate both the strong watermark and the weak watermark; and

a watermark insertion unit to selectively insert one of the strong watermark or the weak watermark into the audio signal based on whether the magnitude components exceed or fall below the hearing threshold.

25. An audio watermarking architecture as recited in claim 22, wherein the watermark detecting system comprises:

a converter to convert a watermarked audio signal into magnitude and phase components;

a mask processor to determine a hearing threshold for corresponding magnitude components;

a pattern generator to generate both a strong watermark and a weak watermark; and

a watermark detector to detect presence of the strong watermark and the weak watermark in the audio signal.

26. A method for watermarking an audio signal, comprising:

watermarking a first portion of the audio signal with a strong watermark; and

watermarking a second portion of the audio signal with a weak watermark.

27. A method for watermarking an audio signal, comprising:

comparing samples of the audio signal to a hearing threshold;

watermarking samples exceeding the hearing threshold with a strong watermark; and

watermarking samples falling below the hearing threshold with a weak watermark.

28. A method as recited in claim 27, wherein the watermarking samples comprises:

watermarking samples exceeding the hearing threshold plus a buffer value with a strong watermark;

watermarking samples falling below the hearing threshold by less than the buffer value a with a weak watermark; and

leaving samples lying within the buffer value above and below the hearing threshold without a watermark.

29. A method as recited in claim 27, further comprising detecting the strong watermark and the weak watermark in the audio signal.

30. A method as recited in claim 29, wherein the detecting comprises computing a correlation value from the audio signal and the strong watermark, the correlation value tending toward a first value when the strong watermark is present and a second value when the strong watermark is not present.

31. A method as recited in claim 29, wherein the detecting comprises computing a correlation value from the audio signal and the weak watermark, the correlation value tending toward a first value when the weak watermark is present and a second value when the weak watermark is not present.

32. A method as recited in claim 27, further comprising:

computing a correlation value from the audio signal and one of the strong watermark or the weak watermark; and

determining that said one strong watermark or weak watermark is present when the correlation value exceeds a predetermined threshold plus a random amount.

33. A method comprising:

encoding an audio signal with both a strong watermark and a weak watermark; and

detecting a presence of the strong watermark and the weak watermark in the audio signal.

34. A computer readable medium having computer executable instructions for:

watermarking a first portion of an audio signal with a strong watermark; and

watermarking a second portion of the audio signal with a weak watermark.

35. A computer readable medium having computer executable instructions for:

comparing samples of an audio signal to a hearing threshold;

watermarking samples exceeding the hearing threshold with a strong watermark; and

watermarking samples falling below the hearing threshold with a weak watermark.